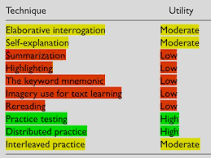
## **Top 10 Learning Techniques: Ranking From Best to Worst**

## Excerpt from article by John Dunlosky and Katherine Rawson

School is for learning. But ironically, one of the things that people don’t really learn to do well in school is to learn. We are taught rote memorization and told to absorb it for arbitrary tests without being taught how to effectively learn the material, and it seems as if the methods we were taught in school aren’t all that effective. In a meta-analysis (a study analyzing other studies) published several years ago, 10 of the most popular learning techniques were studied and ranked for their effectiveness. Then the methods were categorized as low, moderate, or high in terms of utility (effectiveness) in absorbing learned material.

Highlighting/marking/underlining, summarizing, and rereading—-all popular study methods taught in school—-registered as low utility. Each method was then evaluated as either low, medium, or high in terms of utility.



**High Efficiency Study Methods** Practice testing and distributed practice received a high utility assessment because they benefit learners of many age groups and abilities, and have been shown to boost academic performance across a multitude of testing conditions and testing materials. Additionally, high utility study methods do not require extensive training in relation to their gained benefits.

***Practice Testing (High)*** This should come as no surprise—practice testing has been lauded by learning experts as one of the best ways to retain information. Practice testing has over 100 years of research to back up its effectiveness. Simply put, it works.  
 Practice testing doesn’t need to be an actual test in a testing environment. In reality, you can test yourself anytime, anywhere, and with anything. You can test yourself in your head by asking yourself questions and answering them. You can also test yourself by using flash cards. or doing practice problems without the aid of notes or textbook material. And yes, you can test yourself by setting yourself up in a testing environment.  
 Two theories have been put forth as to why testing works: 1) testing enhances retention by triggering elaborative retrieval processes by accessing your long-term memory and retrieving associated information and 2) testing facilitates the encoding of more effective mediators via cues and targets. Additionally, recent evidence suggests that practice testing also improves the ability of students to mentally organize their knowledge, thereby increasing the speed and efficiency of the information retrieval process.

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| **Tips for practice testing**: Studies show that immediate retesting without time between tests does very little good in increasing learning. Rather, practice testing should be done when enough time has elapsed between practice tests. |

***Distributed Practice (High)***  
 Distributed practice is the method of dividing your studies over time intervals rather than doing it in one large chunk. This is why cramming for tests does not work; studies have repeatedly shown that distributed practice is better for material retention and absorption. The reason distributed practice works is because it gives the brain time to absorb the information by switching back and forth between focused and diffused modes of thinking. The evidence is pretty clear that spacing your studies is important to remembering what you learn.

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| **Tips for distributed practice:** Most classes span 3-4 months in length and have between two to four big tests during that time, along with weekly quizzes and homework. The best thing to do with a test for school is to use the 24 hour spacing interval to restudy your material. Within the first several days of learning, you should space out your learning between every 24 hours. After the first four review sessions with 24 hours between each review, your sessions can be less detailed with larger intervals between them. |

Combine distributed practice and practice testing and your test scores should skyrocket. For the overwhelming majority of your academic endeavors, distributed practice combined with practice testing is enough to ace your exams and learn the material.  
 **Moderate Efficiency Study Methods**  
 Elaborate interrogation, self-explanation, and interleaved practice received moderate utility assessments. They are rated as moderate because more research needs to be done in the efficacy of the methods; the efficacy was variable across tasks and topics, and/or some in-depth training was required. However, the general consensus from the various research studied in the meta-analysis shows that it works.  
***Elaborative Interrogation (Moderate)***  
 Elaborative interrogation is the process of asking yourself “*why”* in an attempt to understand concepts. For instance, if you are learning about E=MC^2, a starting question you might ask yourself is “why does E equal MC^2?”. This method is extremely simple to use and requires no training; however it does require some familiarity with the topic (and related topics) to be effective.  
 One benefit of this method is that it is not very time consuming. One study on self-paced learning showed that elaborative interrogation took 32 minutes (reading + elaborative interrogation) compared to 28 minutes for the reading-only group. This is good news since reading can be seen as monotonous, so elaborative interrogation done during reading can enhance learning by reducing the monotony.  
 However, elaborative interrogation is limited to answering factual statements, such as the E=MC^2 statement above. When learning about a complex chain of relationships, such as the digestive system this method may not work as well.

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| **Tips for elaborative interrogation:** Elaborative interrogation can be very effective when done frequently. As you are reading, be sure to check your understanding of the material by asking yourself questions every couple of paragraphs or so. Research suggests that the gains from this technique are diluted when elaborative interrogation is only employed once every 1-2 pages. To make further use of this technique, use a notebook to write down the questions you are asking as well as the answers as you are reading along. This practice of writing down your questions/answers further commits the material to memory. |

***Self-Explanation (Moderate)***  
 Self-explanation is a close relative of elaborative interrogation. This method involves the participant explaining and recording how one reaches an answer or conclusion. This is actually a popular method for solving abstract problems and similar to the requirement in many math classes of showing how you solved specific problems. This was found to be more effective when done during the initial learning stage, instead of after learning a process. This learning strategy can be applied to a whole variety of tasks and subjects. However, studies show that this method does require some training and is one of the more time consuming methods of study. Additionally, there have not been too many studies that have tested long-term retention of the material learned through self-explanation; most studies administered testing minutes after the conclusion of the tasks.

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| **Tips for self-explanation:** When doing self-explanation, it helps to write out the questions that you want to ask yourself and then write down the answers. The process of writing the questions and answers down further commits the concepts to memory, and lets your brain organize the importance of the materials. |

***Interleaved practice (Moderate)***

Interleaved practice is when the student studies the topic at hand but also blends the study with previous topics/concepts at the same time. For instance, if a student is learning the concept of polynomials this week in Algebra but learned about simplifying algebraic equations, and solving inequalities the previous couple of weeks, then interleaved practice means that the student should spend most of his time studying polynomials but also spend a fair amount of time simplifying algebraic equations and solving inequalities.

This method was talked about extensively in Barbara Oakley’s book **A Mind for Numbers.** She is a heavy proponent of interleaved practice and its cousin, spaced repetition. The studies show that this method has tremendous potential to improve learning and retention of science and mathematics. Additionally, interleaved practice helps in many other cognitive skills.  
 Although studies on this method are sparse, a few of them show that the method may not work in some scenarios. However, this may be because of implementation, a lack of training, or because interleaved practice does not work across a broad range of subjects. The authors of the study acknowledged that there seems to be a lot of potential in this method, but there needs to be more research done before it is regarded as a high utility method.